SOILS INVESTIGATION

WAOKANAKA GARDENS

NUUANU, OAHU, HAWAII

TMK: 1-9-02: Portion of Parcel I

for

BUDGET REALTY

W.O. 187

April 16, 1973

ERNEST K. HIRATA & ASSOCIATES, INC.

ERNEST K. HIRATA & ASSOCIATES, INC.
Soils and Foundation Engineering
1157 South King Street • Honolulu, Hawaii 96814 • Phone 531-5733

April 16, 1973
W.O. 187

Budget Realty
c/o Fukunaga & Associates, Inc.
Room 2F
2615 South King Street
Honolulu, Hawaii 96814

Attention: Mr. Ed Fujnaga

Gentlemen:

Our report "Soils Investigation, Waokanaka Gardens, Nuuanu, Oahu, Hawaii, TMK: 1-9-02: Portion of Parcel 1," dated April 16, 1973, our work order 187 is enclosed. This is the report requested by you and planned in cooperation with Fukunaga & Associates, Inc., Civil Engineers.

This investigation was authorized to determine the subsurface soil conditions at the site and to determine if any unusual or adverse conditions might exist which would affect the proposed development.

The soils encountered on the site can be classified as colluvium deposits formed from the weathering of the Koolau Mountain Range. The surface soil consisted of a dark brown organic silty clay down to a maximum depth of one foot. Underlying the surface soil was a dark brown silty clay ranging in thickness from 3.5 to 7 feet. A mottled orange to dark brown clayey silt was encountered beneath the silty clay.

The site is feasible for the proposed development provided the recommendations in this report are followed.

We appreciate the opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

Ernest K. Hirata & Associates, Inc.

Ernest K. Hirata

Ernest K. Hirata

EKH:gk

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SOILS INVESTIGATION

WAOKANAKA GARDENS

NUUANU, OAHU, HAWAII

TMK: 1-9-02: Portion of Parcel I

INTRODUCTION

This report presents the results of our soils investigation conducted on the subject property. The scope of this investigation was planned in cooperation with Fukunaga & Associates, Inc., Civil Engineers and Mr. Robert Pang, Structural Engineer.

This investigation was authorized to determine the subsurface soil conditions at the site and to provide preliminary recommendations for the proposed development.

SITE DESCRIPTION

The proposed site is located at the base of the slope leading up to Kekoalele Ridge in Nuuanu Valley. The site extends approximately 220 feet Ewa of Waokanaka Road with a 22 feet road frontage.

Existing residential homes exist on the northern and southern boundaries of the subject area.

Large boulders were observed over the entire site along with some existing rock walls. The area is heavily vegetated with trees and shrubs.

PROPOSED GRADING

The proposed planned unit development will include seven townhouse units in clusters. The structures will be of post and beam construction with pole type foundations.

Grading will primarily be limited to the construction of a 20 foot wide road leading into the central portion of the site. Some retaining walls will be constructed adjacent to the roadway.

FIELD EXPLORATION

Field exploration was performed between March 14th through the 23rd, 1973 using a skid mounted rotary auger drilling machine.

A total of six exploratory borings were drilled ranging in depth from 10 to 15 feet. The soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System.

Undisturbed and bag samples were recovered from the borings for laboratory testing. Undisturbed samples were obtained by driving a thin walled steel sampler with a 140 pound hammer

from a height of 30 inches. The required blow count for each 6 inches of penetration is shown on the enclosed "Boring Logs", Plates A1 through A6.

SOIL CONDITIONS

The soils encountered on the subject property can all be classified as colluvium deposits formed from the weathering of the Koolau Mountain Range.

The surface soil consisted of a dark brown organic silty clay down to a maximum depth of one foot. Underlying the surface soil was a dark brown silty clay ranging in thickness from 3.5 to 7 feet. The silty clay was found to be stiff with numerous gravels and cobbles in a highly weathered condition.

Underlying the silty clay was a mottled orange to dark brown clayey silt. The clayey silt was found to be medium stiff with mixtures of weathered rock.

LABORATORY TESTING

Laboratory testing was performed on the undisturbed and bag samples to determine their strength characteristics and engineering properties. Laboratory tests included Atterburg Limits, moisture density relationships, consolidations, compaction, swells and CBR. Test results and testing procedures are described in the attached Appendix and in the Boring Logs.

CONCLUSIONS AND RECOMMENDATIONS

A. Slope Stability

It is our opinion that the subject property can be safely developed utilizing a maximium slope gradient of $1\frac{1}{2}$:1 for cut slopes in the silty clay and clayey silts. A slope gradient of 2:1 may be used for fill slopes.

During grading, all loose boulders should be removed from areas above the proposed development to prevent the possibility of damage to future homes.

All slopes should be planted as soon as practical upon completion of grading in order to minimize the effects of erosion and weathering.

B. Groundwater

Groundwater was encountered in borings 1 and 5 at approximate elevations 610 and 644.5 respectively. Subdrains may be required if water is encountered. during the excavation for the roadway. Final determination will be made during grading operations.

C. Lateral Pressures

An equivalent fluid pressure of 60 pounds per cubic foot per foot of depth should be used in the design of retaining walls with sloping surcharge.

Passive Earth pressure may be computed as an equivalent fluid having a density of 250 pounds per cubic foot per foot of depth.

All retaining walls should be backfilled with granular material and properly compacted.

D. Expansive Soils

The results of the loaded swell tests indicate that in the undisturbed condition, the expansion is only slight. However in a remolded state, the soils exhibit a moderate to high expansion potential. We therefore recommend that for any slab on grade placed on fill material, the upper 24 inches of fill should be a non-expansive granular material. In cut areas, slabs may be placed on six inches of crushed rock.

E. Grading

Our investigation indicates that most of the excavations can be made with conventional earth moving equipment. However some large boulders may be encountered in the upper areas of the subject area.

Our minimum Grading Specifications are attached and shall be considered a part of the recommendations except where specifically superceded in the text of this report.

1. All heavy vegetation shall be stripped and wasted from the site.
2. All fill shall be placed and compacted to at least 90% relative compaction using ASTM D-1557-70 laboratory test.
3. The organic silty clay of approximately 12 inches in thickness should be removed where foundations or slabs are to be placed directly on grade.

F. Pavement Design

We recommend that the following section be considered in the design of the pavement.

6"	Concrete
6"	Base Course Compacted to field CBR of 85%
6"	Select Borrow Compacted to 95%
18"	Borrow Compacted to 95%
6"	Subgrade Compacted to 95% for minimum of 6 inches

Very truly yours,

Ernest K. Hirata & Associates, Inc.

ERNEST K. HIRATA
REGISTERED PROFESSIONAL ENGINEER
No. 2732
HAWAII, U.S.A.

Ernest K. Hirata

Ernest K. Hirata P.E. 2732

EKH:gk

APPENDIX OF LABORATORY TESTING

Classification

The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification is determined by both visual examination and Atterburg Limit Tests according to ASTM D423 and D424. The final classification is shown on the Boring Logs.

Moisture-Density

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples. The information is useful in providing a gross picture of the soil consistency between borings and any local variations. The dry unit weight is determined in pounds per cubic foot while the moisture content is determined as a percentage of the dry unit weight. These samples are obtained from a 3" O.D. split tube sampler.

Consolidation

Settlement predictions of the soil's behavior under load are made on the basis of the consolidation tests. Loads are applied in several increments in a geometric progression, and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen having an inside diameter of 2.40 inches and a height of 1 inch to permit addition and

release of pore fluid. Results of undisturbed and remolded samples are plotted on the Consolidation Test Report.

Compaction Tests

Compaction tests were performed on bag samples to determine the optimum moisture content at which each type of proposed fill material compacts to 100% density. The tests were performed according to the Modified AASHO T-180.

Swell Tests

Swell tests were performed to determine the expansiveness of the onsite surface soils. The tests were performed on undisturbed ring and remolded samples taking a one inch high specimen under different surcharge loads.

Shear Tests

Shear tests are performed in the Direct Shear Machine which is of the strain control type. The rate of deformation is approximately 0.03 inches per minute. Each sample is sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Eighty percent of the ultimate value is taken to determine the shear strength parameters.

Unconfine Compression Test

The unconfine compression test of a soil is a uniaxial compression test in which the test specimen is provided with no lateral support while undergoing vertical compression. The minimum height of the test specimen is at least 2.5 times the diameter of the ring. The rate of deformation varied between 1 to 2 percent. The test measures the unconfine compressive strength of a soil and, indirectly, the shearing strength.

ERNEST K. HIRATA & ASSOCIATES INC.

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the control of Ernest K. Hirata & Associates Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the preliminary soils report, or in other written communication signed by the Soils Engineer.

I. GENERAL

A. The Soils Engineer is the Owner's or Builder's representative on the project. For the purpose of these specifications, supervision by the Soils Engineer includes that inspection performed by any person or persons employed by, and responsible to, the licensed Civil Engineer signing the soils report.

B. All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the supervision of the Soils Engineer.

C. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Soils Engineer. The Contractor shall also remove all material considered unsatisfactory by the Soils Engineer.

D. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

E. A final report shall be issued by the Soils Engineer attesting to the Contractor's conformance with these specifications.

II. SITE PREPARATION

A. All vegetation and deleterious material such as rubbish shall be disposed of offsite. This removal must be concluded prior to placing fill.

B. Soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as a part of a compacted fill must be approved by the Soils Engineer.

C. After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches.

Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Soils Engineer.

D. Any underground structures such as cesspools, cisterns, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer.

III. COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Soils Engineer.

B. Rock fragments less than six inches in diameter may be utilized in the fill, provided:

1. They are not placed in concentrated pockets.

2. There is a sufficient percentage of fine-grained material to surround the rocks.

3. The distribution of the rocks is supervised by the Soils Engineer.

C. Rocks greater than six inches in diameter shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

E. Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Soils Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Soils Engineer as soon as possible.

F. Material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Soils Engineer.

G. If the moisture content or relative density varies from that required by the Soils Engineer, the Contractor shall rework the fill until it is approved by the Soils Engineer.

H. Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency.

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soil report.

I. All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Soils Engineer.

J. The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report.

K. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Soils Engineer.

L. The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Soils Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified of such conditions by written communication from the Soils Engineer in the form of a conference memorandum, to avoid any misunderstanding arising from oral communication.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Soils Engineer.

M. All fill slopes should be planted or protected from erosion by methods specified in the soils report.

N. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill.

IV. CUT SLOPES

A. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Soils Engineer; and recommendations shall be made to treat these problems.

B. Unless otherwise specified in the soils report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

C. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Soils Engineer.

V. GRADING CONTROL

A. Inspection of the fill placement shall be provided by the Soils Engineer during the progress of grading.

B. In general, density tests shall be made at intervals not exceeding two feet of fill height of every 500 cubic yards of fill placed. This criteria will vary

depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

C. Density tests shall also be made on the surface material to receive fill as required by the Soils Engineer.

D. All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Soils Engineer prior to placing any fill. It shall be the Contractor's responsibility to notify the Soils Engineer when such areas are ready for inspection.

VI. CONSTRUCTION CONSIDERATIONS

A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of inspections by the Soils Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Soils Engineer.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B1 DRIVING WT. 140 lb. DATE OF DRILLING 3-14-73

SURFACE ELEV. 619 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (OH) - Dark brown, organic, moist, firm.
	x		5 7 10	77.4	55.5				Silty CLAY (MH) Dark brown, moist, medium stiff with occassional cobbles.
5	x		10 15	74.6	43.3		36.5°	0.85 KSF	
	x		14 6 9	67.1	57.9				Clayey SILT (ML-MH) - Mottled orange, moist, medium stiff with weathered rock.
10			17/4.5"	68.5	56.0				End boring at 10 feet. ▽ Water level at 8.8 feet.
15									
20									
25									
30									

Plate A1

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B2 DRIVING WT. 140 lb. DATE OF DRILLING 3-14-73

SURFACE ELEV. 633 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (OH) - Dark brown, organic, moist, firm.
	x		5 11 12	65.8	55.7				Silty CLAY (MH) - Dark brown, moist, medium stiff. Grading to mottled orange color with cobbles from 3.5 feet
5	x		11 35 27	79.4	41.8				Clayey SILT (ML-MH) - Dark brown, moist, stiff with mixtures of cobbles and gravel which are highly weathered.
10	x		19 20 22	82.8	40.0				
15	x		10 18 20	69.3	54.7				Weathered Rock - Mottled grayish brown, moist, stiff.
									End boring at 15 feet.
20									
25									
30									

Plate A2

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B3 . DRIVING WT. 140 lb. DATE OF DRILLING 3-15-73

SURFACE ELEV. 667 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (OH) - Dark brown, moist, firm.
	x		13 19 30	75.9	42.0				Silty CLAY (MH) - Dark brown, stiff, moist with mixtures of weathered rock.
5	x		13 22 32	77.7	33.6		UNCONFINE 12.93 KSF		Clayey SILT (ML-MH) - Mottled brown, moist, stiff with mixtures of weathered rock.
	x		11 25 36	76.8	42.6				
10	x		10 22 33	89.2	44.4				
									End boring at 13 feet.
15									
20									
25									
30									

Plate A3

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B4 DRIVING WT. 140 lbs. DATE OF DRILLING 3-21-73

SURFACE ELEV. 680 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/ 6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (MH) - Dark brown, moist, with boulders. Coring from 2.5 to 4.4 feet.
5	x		7 12 21	71.5	34.3		54.5°	0.48 KSF	Clayey SILT (ML-MH) - Dark brown, moist, medium stiff with weathered rock and gravel.
10	x		10 20 33	71.2	44.2				Grading to mottled orange color from 10 feet.
	x		9 23 28	89.6	45.9				
15									End boring at 15.0 feet.
20									
25									
30									

Plate A4

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B5 DRIVING WT. 140 lb. DATE OF DRILLING 3-22-73

SURFACE ELEV. 668 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/ 6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (OH) - Dark brown, organic, moist, firm.
	x		7 21 30	82.2	38.9		52.0°	0.61 KSF	Silty CLAY (ML) - Dark brown, moist, stiff with weathered rock and gravel.
5	x		7	No Recovery					
	x		27 44 18	78.6	45.4				Clayey SILT (ML-MH) - Dark brown, moist, stiff, with weathered rock and gravel.
10 ▽	x		21	55.1	49.8				
15									End boring at 14.0 feet. ▽ Water encountered at 13.5 feet.
20									
25									
30									

Plate A5

ERNEST K. HIRATA & ASSOC.

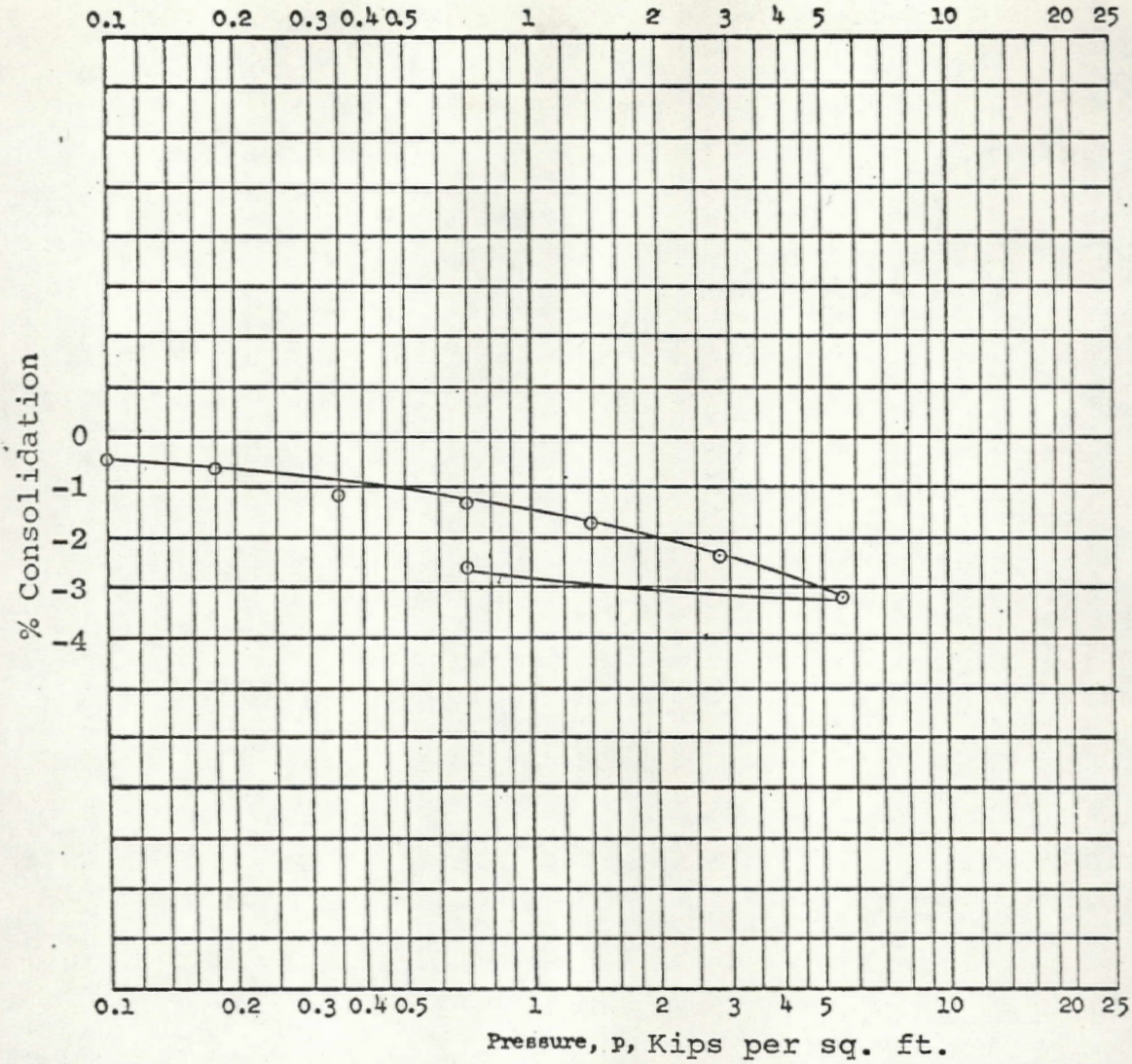
BORING LOG

BORING NO. B6 DRIVING WT. 140 lb. DATE OF DRILLING 3-23-73

SURFACE ELEV. 635 ± DROP 30 in. W.O. 187

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/ 6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY with Boulders - Dark brown, moist.
	x		6 6 8	67.9	47.0				Silty CLAY (MH) - Dark brown, moist, firm, with weathered rock.
5	x		9 15 22	64.2	58.6				Clayey SILT (ML-MH) - Mottled brown, moist, medium stiff with weathered rock and gravel.
	x		17 24 33	73.2	49.4		UNCONFINE 7.55	KSF	
10	x		21 48	70.1	46.6				Grading to mottled orange color from 13 feet.
15									End boring at 14.5 feet.
20									
25									
30									

Plate A6



Type of Specimen	Undisturbed	Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	61.5 %	w_f	49.9 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	65.4 lb/ft^3		
Classification MH		k_{20} at e_o =	x 10$^-$ cm/sec		
LL	G_s	Project Waokanaka Gardens			
PL	D_{10}	Budget Realty - Nuuanu			
Remarks Water added at 700 PSF		Area W.O. 187			
		Boring No. B1		Sample No.	
		Depth El 8.5'		Date 3-23-73	
		CONSOLIDATION TEST REPORT			

ENG FORM 2090
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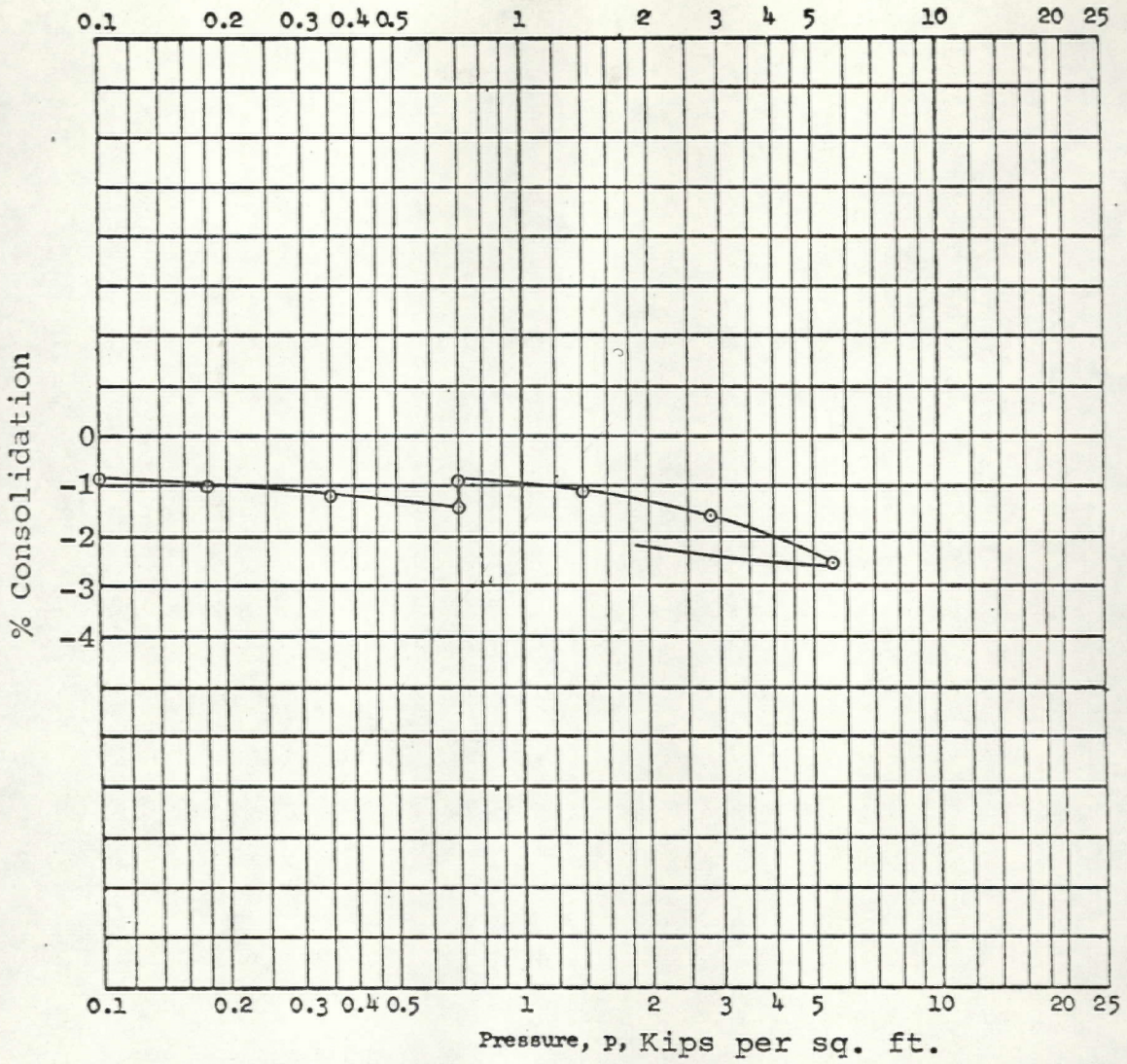
0 3424

Plate B1

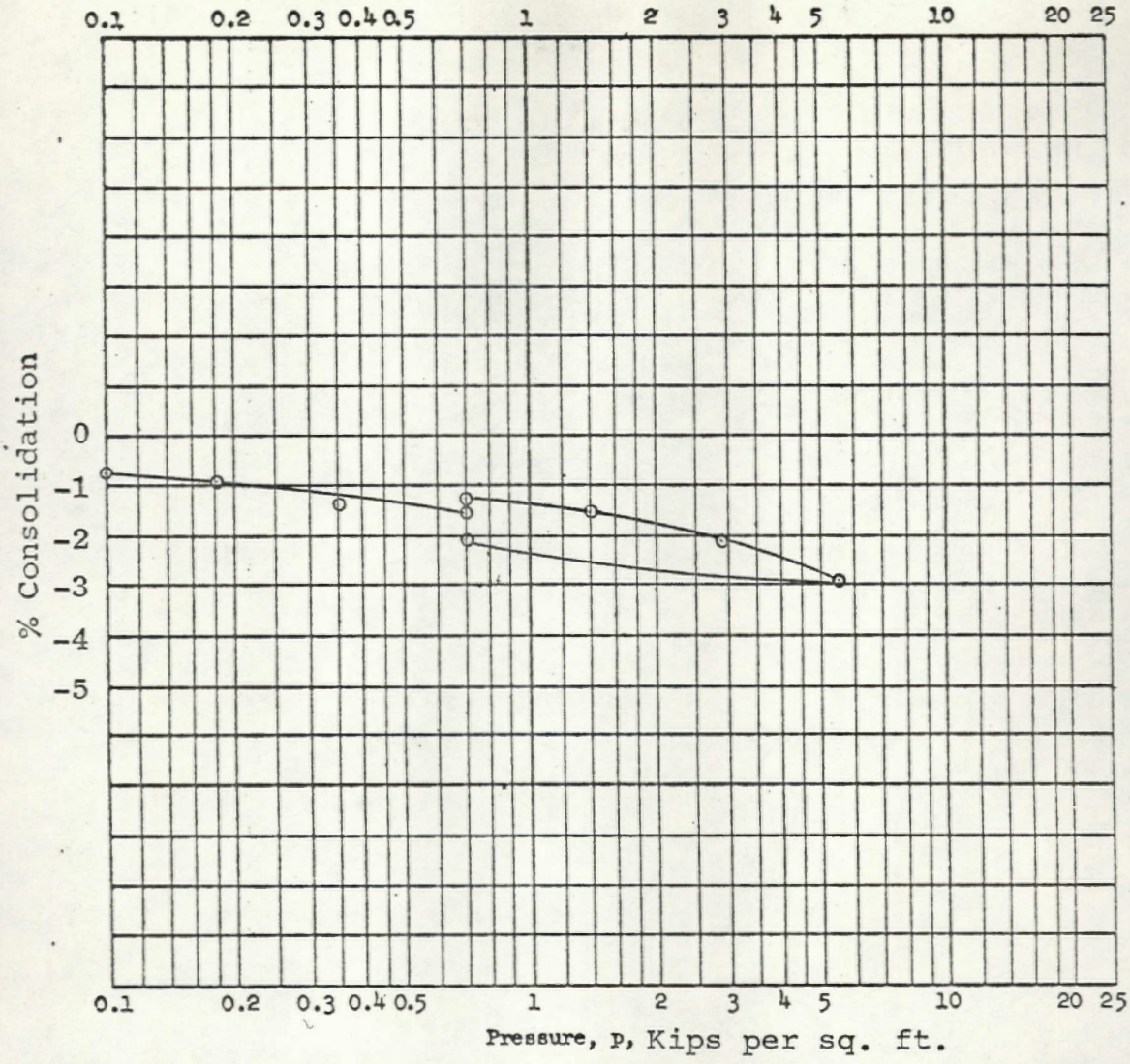


Type of Specimen	Undisturbed	Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	41.8 %	w_f	25.1 %
Overburden Pressure, p_o	T/sq ft	Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c	T/sq ft	Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	79.4 lb/ft^3		
Classification	MH	k_{20} at e_o =	x 10$^-$ cm/sec		
LL	G_s	Project	Waokanaka Gardens		
PL	D_{10}		Budget Realty - Nuuanu		
Remarks	Water added at 700 PSF	Area	W.O. 187		
		Boring No.	B2	Sample No.	
		Depth / El	6'	Date	3-19-73
		CONSOLIDATION TEST REPORT			

ENG FORM 2090
1 MAY 63

0 3424

Plate B2

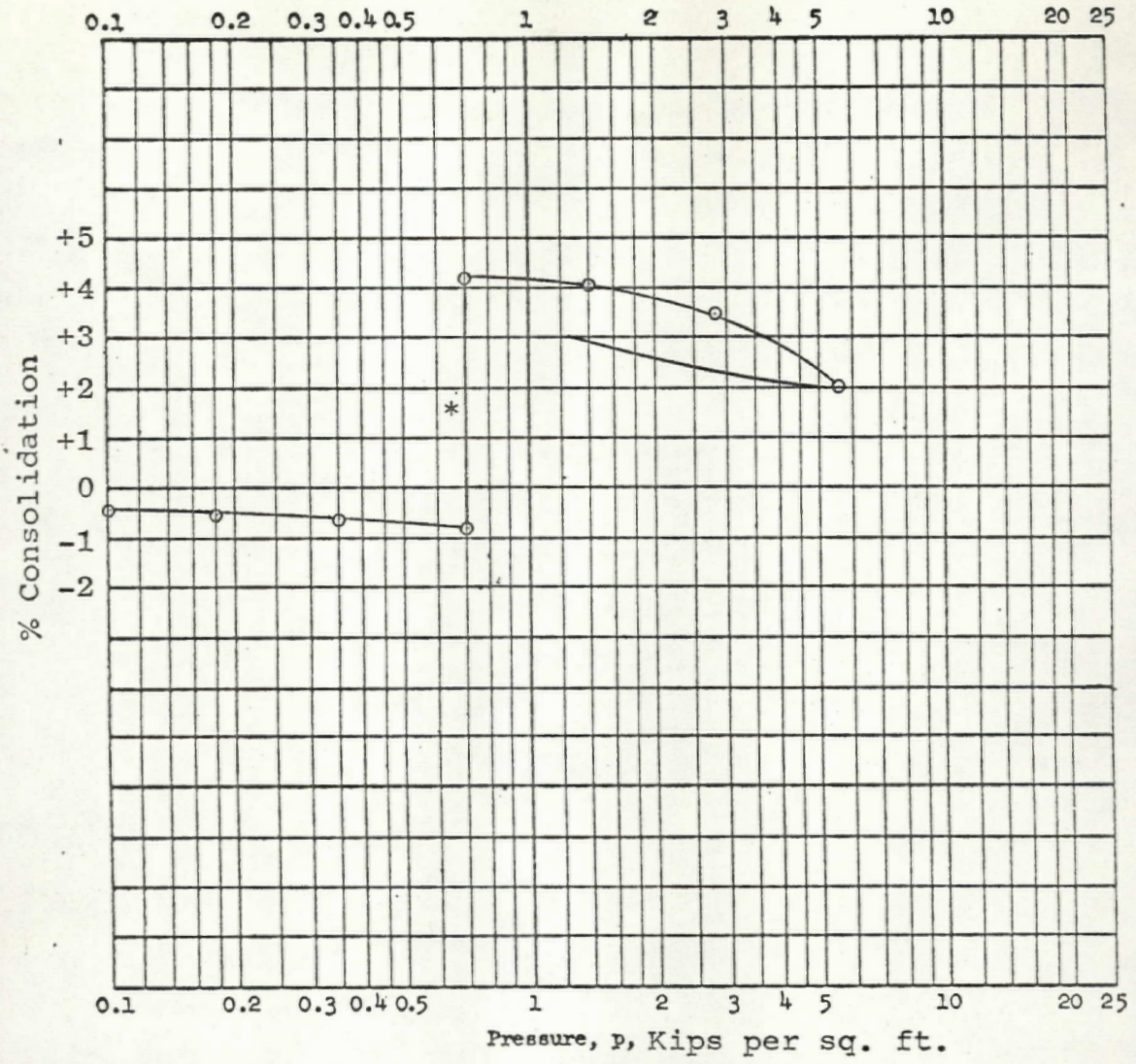


Type of Specimen	Undisturbed	Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	49.4 %	w_f	53.1 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	73.2 lb/ft^3		
Classification MH		k_{20} at e_o =	$\times 10^{-}$ cm/sec		
LL	G_s	Project Waokanaka Gardens			
PL	D_{10}	Budget Realty - Nuuanu			
Remarks Water added at 700 PSF		Area W.O. 187			
		Boring No. B6		Sample No.	
		Depth 9' El		Date 3-27-73	
		CONSOLIDATION TEST REPORT			

ENG FORM 2090
1 MAY 63

0 3424

Plate B3



Type of Specimen	Remolded	Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	%	w_f	%
Overburden Pressure, p_o	T/sq ft	Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c	T/sq ft	Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	lb/ft^3		
Classification	MH	k_{20} at e_o =	$\times 10^{-}$ cm/sec		
LL 51.5	G_s	Project Waokanaka Gardens			
PL 43.5	D_{10}	Budget Realty - Nuuanu			
*Remarks Water added at 700 PSF		Area W.O. 187			
		Boring No. B1	Sample No.		
		Depth 0-10' El	Date 3-28-73		
		CONSOLIDATION TEST REPORT			

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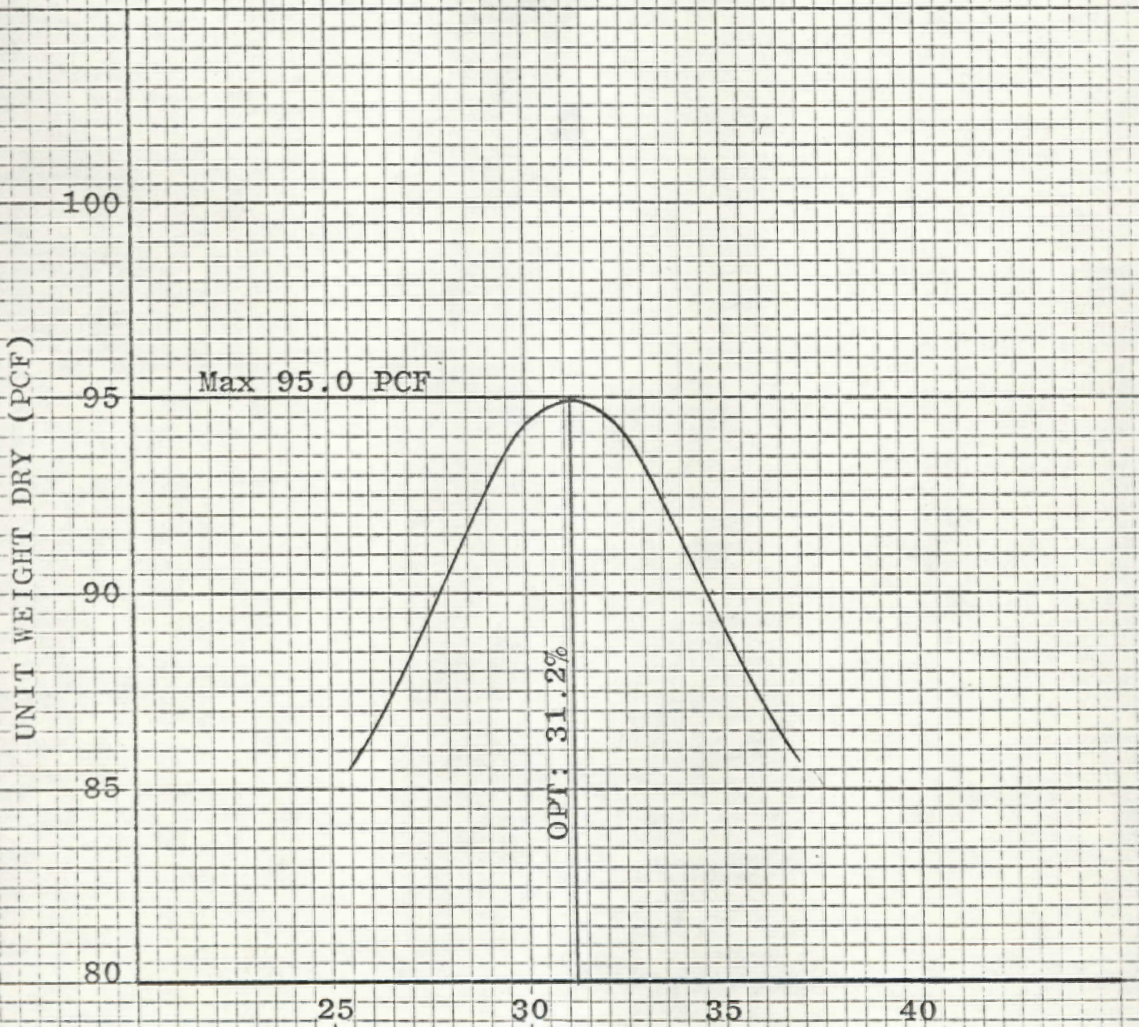
Plate B4

MAXIMUM DENSITY CURVE



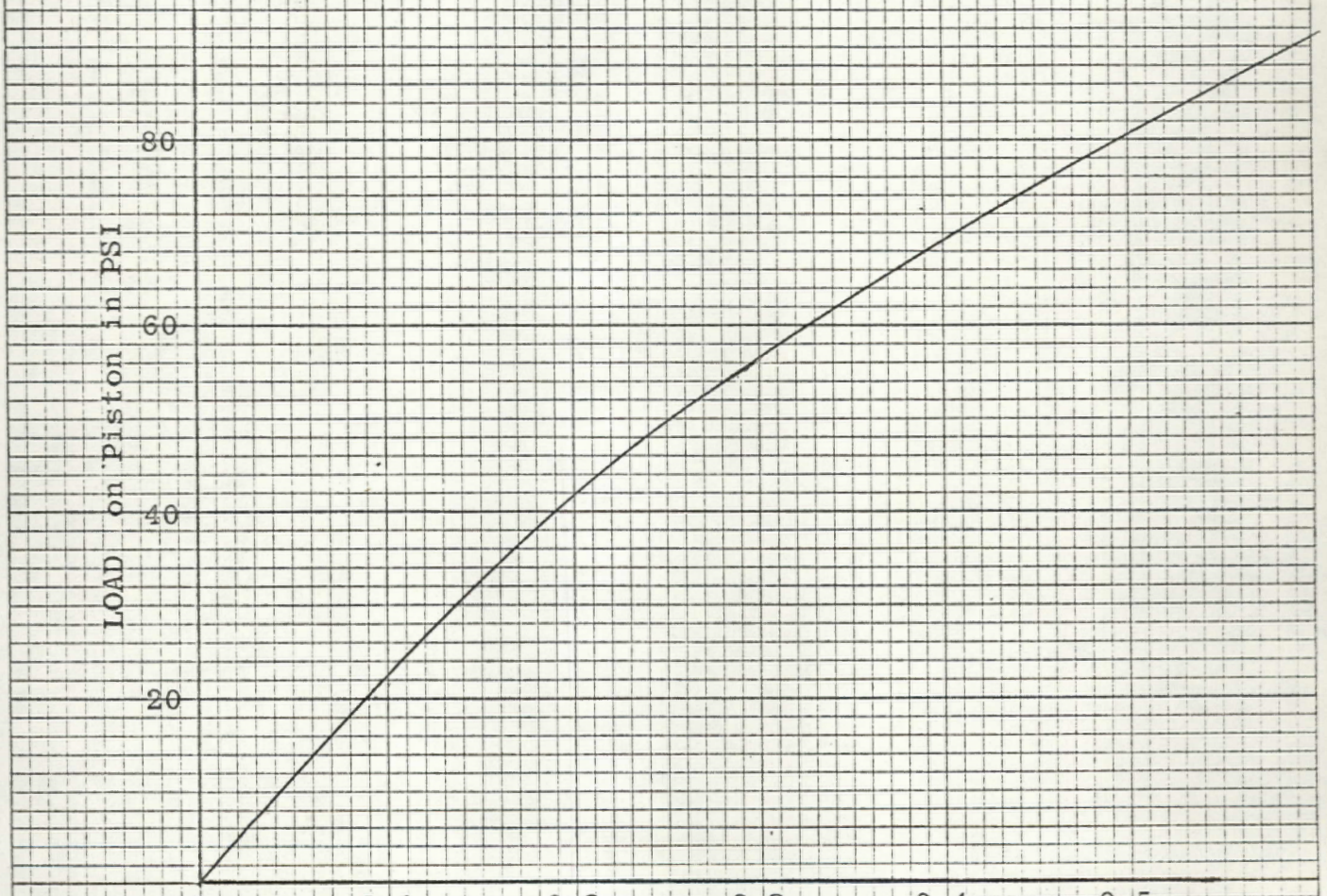
Boring: B1

Depth: 5' - 10'

Classification: Dark brown Silty CLAY

W.O. 187

CBR STRESS-PENETRATION CURVE



Soil Description: Dark brown Silty CLAY

Location: B1 5' - 10'

W.O. 187

Max. Density = 95.0

Opt. Moisture = 31.2%

Swell = 5.3%

CBR @ 0.1 = 2.2

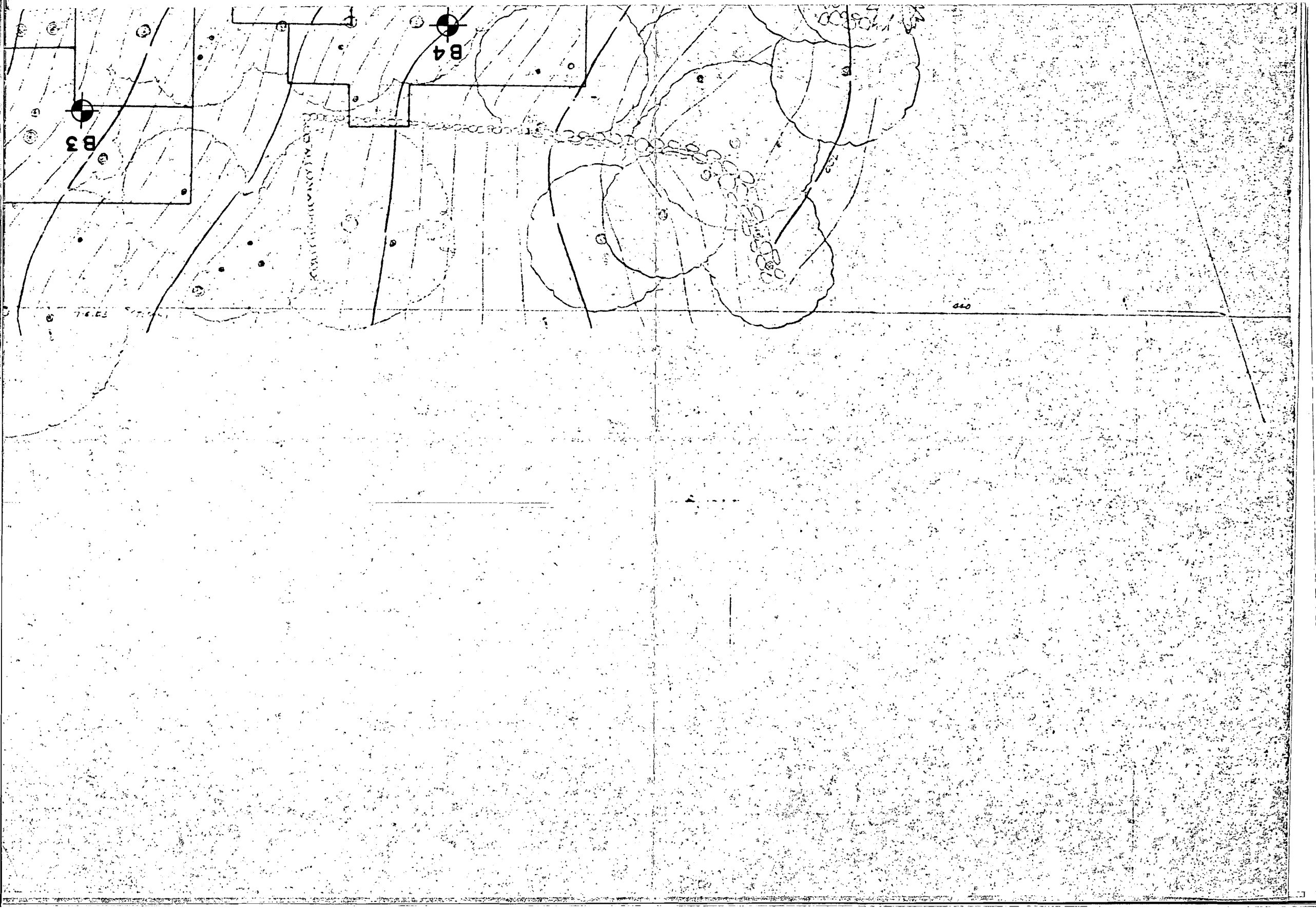
LABORATORY TEST RESULTS

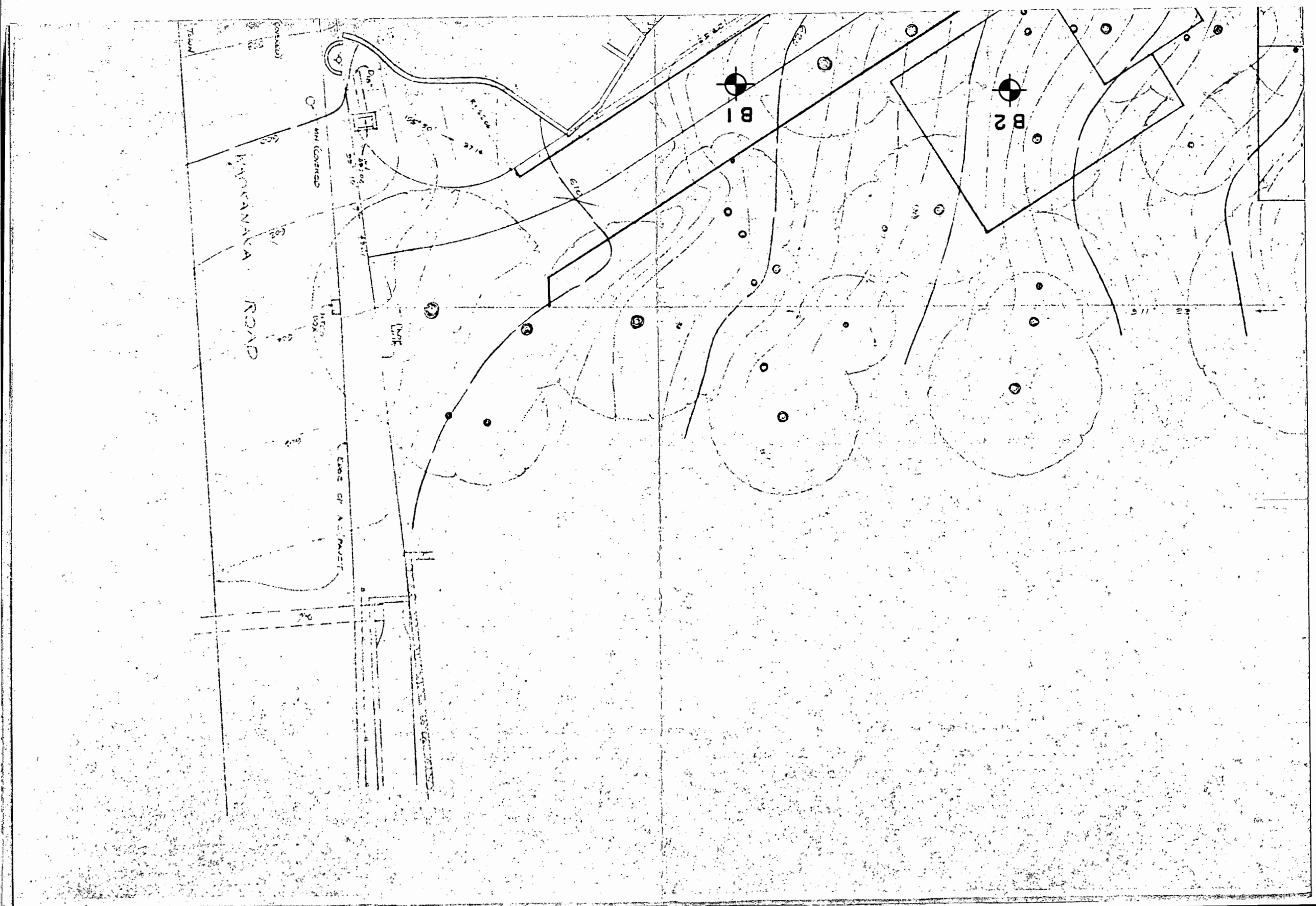
Project: Waokanaka Gardens W.O. 187

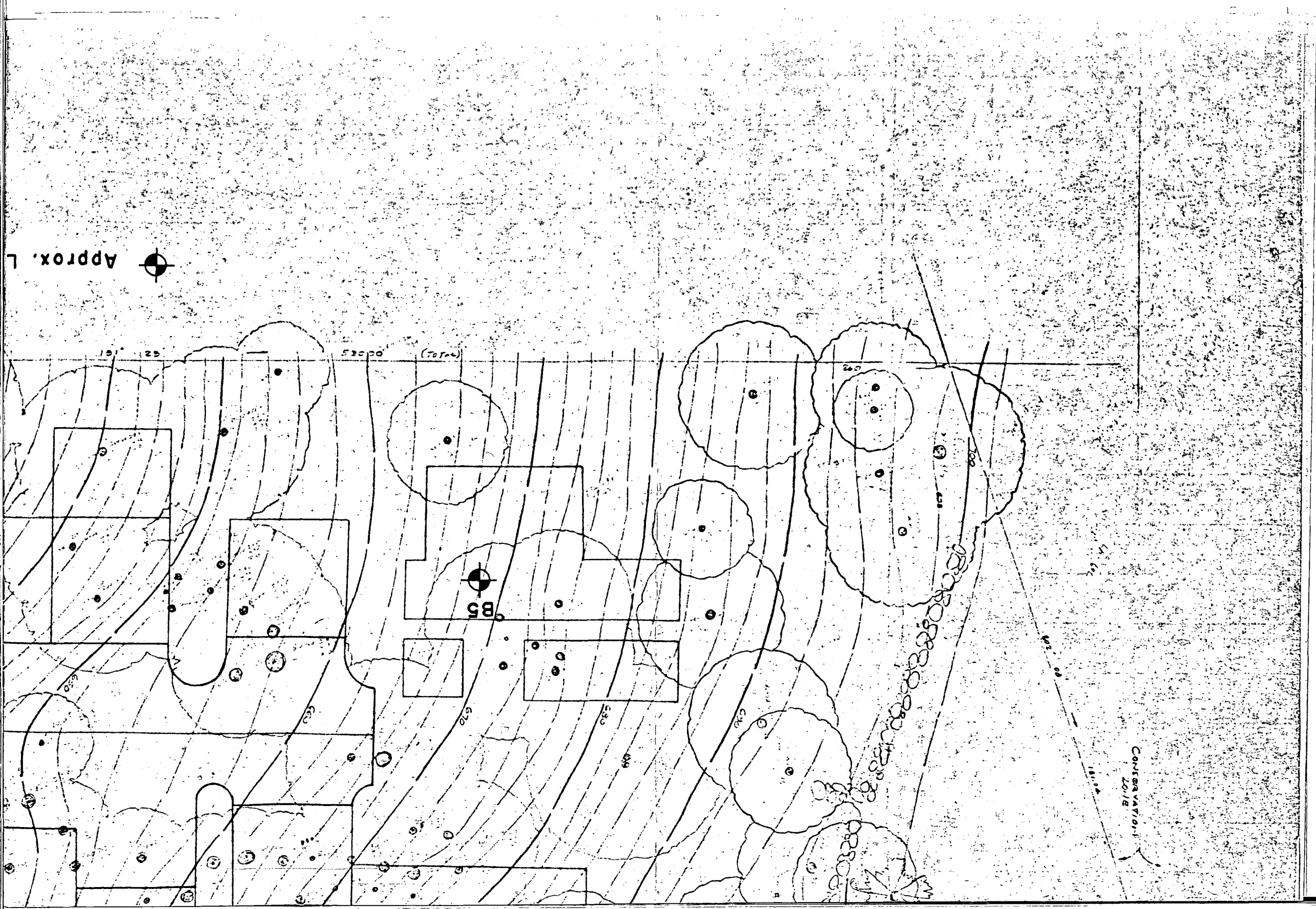
Boring or Test Pit No.		B1	B2	B3	B6	
Depth (ft.)		5'-10'	6	3	9	
Atterburg Limit Tests						
Liquid Limit		51.5				
Plastic Limit		43.5				
Plastic Index		8.0				
Soil Classification		ML-MH	ML-MH	MH	ML-MH	
Expansion @ 60 PSF						
Natural						
Remolded		11.6%				
Expansion @ 700 PSF						
Natural			0.5%	0.4%*	0.3%	
Remolded		5.1%				
Unconfine Stress (PSF)					7550	
Proctor						
Max. Dry Unit Wt. (PCF)		95.0				
Optimum Water (%)		31.2				
Wet Density In-Place (PCF)			112.6	107.8	109.4	
Moisture In-Place (%)			41.8	42.0	49.4	
Dry Unit Wt. In-Place (PCF)			79.4	75.9	73.2	
Direct Shear (Remolded)	Ø	77°				
	C (KSF)	1.7				

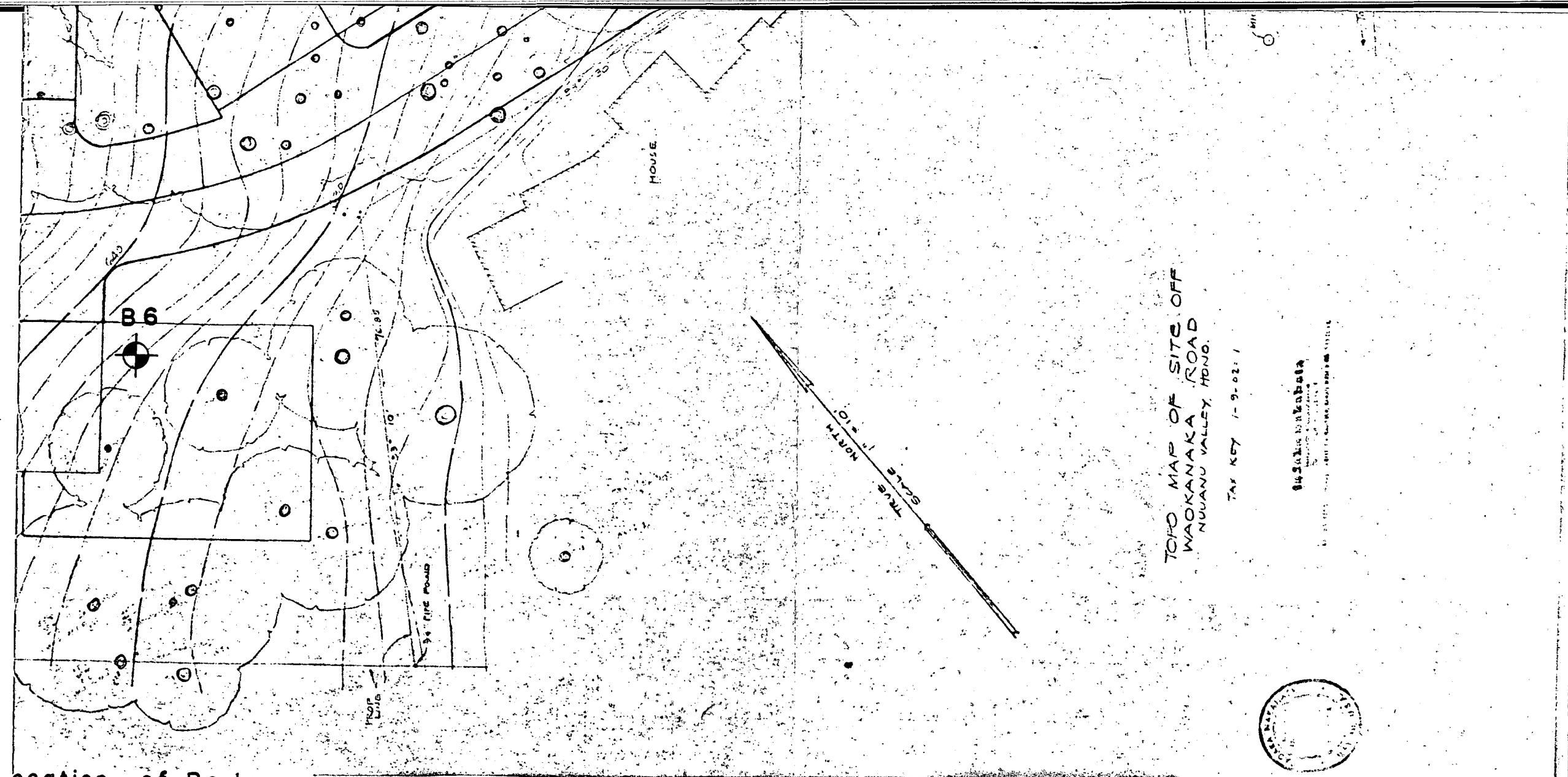
* Surcharge load of 350 PSF

Plate E


B4
B3


B1
B2
KAHKAWAKA ROAD
EDGE OF PAVEMENT


Approx. L
B5
CONSERVATION ZONE



ocation of Borings

ERNEST K. HIRATA & ASSOCIATES, INC.

Soils and Foundation Engineering

1157 South King Street Honolulu, Hawaii

Date April 12, 1973 W.O. 187